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METASTATIC CARCINOMA OF THE CHOROID. WITH REPORT OF A CASE AND REVIEW OF THE LITERATURE.

BY E. L. OATMAN, M.D.,
OF BROOKLYN, N. Y.,
SURGEON TO THE MANHATTAN EYE AND EAR HOSPITAL, NEW YORK; PATHOLOGIST TO THE MANHATTAN EYE AND EAR HOSPITAL, NEW YORK.

THE medical history of carcinoma of the choroid commenced in 1872, when Perls,[1] the pathologist, examined the eyes of a man who had died from carcinoma of the lung, and found metastatic deposits in each choroid. No clinical history of the eye symptoms is given. As the report of this case belongs to the domain of general pathology, it apparently failed to attract the attention of ophthalmologists, as ten years elapsed before the subject again appeared in medical literature, when, in 1882, Hirschberg[2] and Schoeler[3] each exhibited a case before the Berlin Medical Society.

Although cases have occasionally been observed and reported since, carcinoma of the choroid still remains one of the curiosities of ophthalmology. It is, however, not improbable that many cases have escaped a correct diagnosis, for the reason that text-books, by practically ignoring its existence, have failed to place clinicians on the alert for its detection. The value of bearing its possible occurrence in mind is significantly shown by the fact that of the thirty authors quoted five have had two cases each to report.

The following case occurred in my own practice:

P. G., a Belgian, aged fifty-six years, carpenter; family history negative. About one year before he came under my observation a physician told him that he had saccharine diabetes. This disappeared in a few months. He had recently suffered from indigestion and occasional asthmatic attacks. He was well nourished, and no cachexia was apparent. Eye trouble had existed for eighteen months. He first noticed a blur before the left eye. This rapidly increased, and the eye became blind in about six weeks. There was no pain whatever at this time, but about two months before I saw him he began to suffer from violent paroxysms of pain in and around the eye. The increasing frequency and severity of these attacks led him to seek medical relief.

Examination. The right eye was apparently normal in every respect. The left eye had no perception of light. Ciliary congestion was pronounced. Tension was + 1. Cornea and lens were clear. Anterior chamber shallow. The pupil was contracted and fixed by extensive posterior synechia. The ophthalmoscope and oblique illumination revealed a grayish, immovable, non-vascular mass, closely applied to the posterior surface of the lens.

This painless loss of vision, which was followed by eighteen months of quiet and the subsequent development of a rapidly progressing glaucoma, led to the diagnosis of an intraocular growth. After consultation with Dr. Neil Hepburn, an enucleation was advised. The operation was performed under ether on November 11, 1901. Extensive adhesions of the globe to the orbital tissues existed, especially posteriorly. The wound healed kindly, but the general health of the patient failed with alarming rapidity. Rapid emaciation, loss of appetite, cough, and dyspnœa ensued. A laryngological examination by Dr. Beaman Douglas showed a left abductor paralysis of the vocal cord. One week after enucleation the right pleural cavity exhibited evidence of a fluid effusion. Enlargement of the deep clavicular glands on the right side was now first observed. About this time I examined the enucleated eye microscopically, and found that it contained a carcinoma of the choroid. As this could not be a primary growth, it was at once apparent that the patient must have a carcinoma of some other organ, which was rapidly tending to a fatal termination. On November 30th the patient was referred to Dr. W. H. Porter,[4] who placed him in the New York Post-graduate Hospital, where he died December 16, 1901, about eighteen months after the first eye symptoms and thirty-five days after enucleation of the eye.

Necropsy by Prof. H. T. Brooks and Dr. R. H. Halsey, the house surgeon, showed that the primary carcinoma was situated in the liver, with secondary deposits in the choroid of the left eye, the right suprarenal body, the right and left kidneys, spleen, retroperitoneal glands, right bronchus, right lung, and bronchial glands. Within the cranial cavity tumors were found on the falx cerebri, tentorium cerebelli, and in the pia mater resting on the nates. I made numerous microscopic sections of all these deposits for comparison with the choroidal growth.

Anatomical and Microscopic Examination. When the globe was punctured, immediately after enucleation, to facilitate the process of hardening, a thin, yellowish fluid escaped, which resulted in some distortion of the specimen.*

The exterior of the globe, especially in the posterior region, exhibited evidence of the close adhesions it had formed with the surrounding tissues. The hardened eye was sectioned horizontally somewhat below the axis (Fig. 1). The entire posterior and lateral portion of the globe was lined by a grayish-white, knobby, discoid growth. Its centre, which was in the macular region, was 3 mm. in height. From this point it diminished gradually in thickness to its thin-edged periphery, which extended forward to the apex of the ciliary body on the temporal side, and about 9 mm. beyond the optic nerve on the nasal side.

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* This puncture, to allow the "fixing" fluid to enter the interior of the globe, is commonly believed to be essential in preparing eyes for histological examinations. As it often leads to distortion of the specimen, I have since abandoned it as wholly unnecessary.

The retina was completely detached, except at the ora serrata and optic nerve. Behind the retina was an albuminous coagulated mass almost, but not completely, filling the remaining space in the globe. This space of about 1 mm., which existed between the coagulum and the growth, probably contained the fluid which escaped when the puncture referred to above was made.

The growth was a papillary cyst adenocarcinoma (Fig. 2). It was composed of numerous cystic cavities, with connective tissue walls lined by superimposed layers of large cells of the glandular epithelial type, with abundant cytoplasm, large, strongly staining, oval nuclei and well-marked nucleoli. While young and closely packed together they were somewhat columnar in appearance, but wherever relieved from pressure they were large and polyhedral in shape, closely resembling those of the liver or kidney.*

At different points in the cystic cavities the epithelium had multiplied and formed branching elevations, into each of which grew a stem of connective tissue. This arborescent manner of growth presented a striking and fantastic picture under the microscope. All of the cancerous growths present in this case showed the same histological formation wherever they were deposited. Its structure and method of growth can better be understood if its development is traced from an area of fresh invasion backward to the older portions of the growth. At its thin-edged periphery a narrow wedge of epithelial cells could be seen pushing forward in the suprachoroidal space (Fig. 3). The choroid was thus lifted from the sclera entire, but its lymph channels were quickly invaded by cells. Its connective tissue framework, and especially that of the suprachoroidal space, underwent rapid proliferation and formed the carcinomatous stroma, while the enormously enlarged lymph spaces were filled with the characteristic epithelial cells. In the newer portion of the growth the cells preponderated over the stroma, but the older portions exhibited a decided scirrhous tendency. This tendency was well illustrated in the primary liver growth. Here the fresh deposits closely resembled those in the choroid, while the oldest portions were marked examples of scirrhous carcinoma. The distended bloodvessels and capillaries of the choroid with extremely thin walls remained in the stroma, but were supported by an enormously increased amount of connective tissue, throughout which the pigment cells of the choroid were scattered, indicating that the choroidal stroma had now become the framework of the carcinoma.

The presence of cells in the capillaries could not be demonstrated, the progress of invasion being along the lymph spaces; but foci frequently formed in the perivascular lymph channels, and ultimately destroyed the vessel and entered its lumen.

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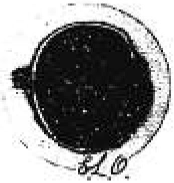
* Their strong resemblance to liver cells was a subject of comment during microscopic examination before the patient's death when speculating on the probable site of the primary growth. However the extreme rarity of primary carcinoma of the liver, the absence of hepatic tumor, and the prominence of the pulmonary symptoms diverted attention from its true location.

Backward toward the older portion of the growth the cystic cavities increased in size, and in some cases occupied the entire thickness of the growth. Their centres were filled by the disintegrating remains of cells and stroma, with a large quantity of grumous material staining with eosin. The latter I interpreted as the débris of dead tissue, since by careful focusing with the microscope I was usually able to demonstrate the dim outlines of cells in all parts of the mass (Fig. 2). These cystic spaces, which appear to be common in carcinoma of the choroid, have led Mitvalski[5] to evolve a theory regarding their origin. He supposes a hemorrhage to occur from obstruction. A clot forms, around which the carcinoma grows. Later on the clot shrinks and disintegrates, leaving a cystic space containing the old grumous blood clot in its centre surrounded by the carcinomatous growth. This highly ingenious theory has no application to the case under consideration. My reasons for this assumption are that the débris was not composed of blood, the potassium ferrocyanide test failing to show the presence of blood pigment. The growth was cystic from the very first, not only in the eye, but in every other organ where metastases were deposited. These large spaces containing débris occurred only in the eye-deposit. In all of the other organs the tendency was for the spaces to decrease in size in proportion to the amount of stroma.

Considering the frequency of this formation in choroidal carcinoma, it is probable that an explanation must be looked for in the anatomical structure of the eye. As stated above, there is a tendency in all of the deposits in this case to become scirrhous. In the liver, for instance, the dead cells are easily absorbed and removed, leaving no obstacle to prevent the obliteration of the cavity by connective tissue. Other conditions, however, prevail in the eye where, with its dense sclerotic coat and with its efferent vessels enveloped in a carcinomatous mass, the absorption and removal of the free cells and cast-off tissues is necessarily a difficult matter; indeed, it is probable that their accumulation, to which constant accessions are being made, will account for the large spaces which have attracted the attention of observers. Hemorrhages were not common, and apparently played but a small rôle in the process of cell necrosis. Such blood pigment as was revealed by the potassium ferrocyanide test was usually found in the stroma. Large hemispherical colloid bodies, apparently springing from the lamina vitrea, were very numerous in the choroid in front of the area of invasion, and were sometimes found also on the surface of the tumor. These bodies were similar in all respects, except their unusual size, to those ordinarily observed in degenerated eyes.

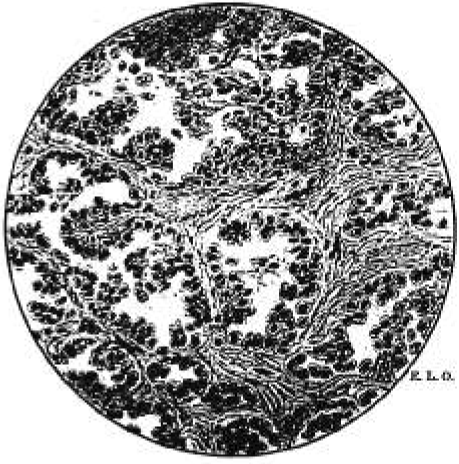
Sclera. Wherever a lymph channel was accessible to the cells the latter immediately entered and established a colony. Thus they invaded the sclera and formed many deposits among its fibres. Posteriorly was a deposit 1 mm. in height entirely outside of the sclera, but between it and the intraocular growth the sclera was so infiltrated with cells and cell nests that this deposit may be regarded as the result of perforation. This tendency of intraocular carcinoma to grow backward and to perforate the sclera by infiltration through its fibres distinguishes it from sarcoma, which almost always manifests a tendency to emerge from the globe along some of the natural openings by bursting through the

FIG. 1.



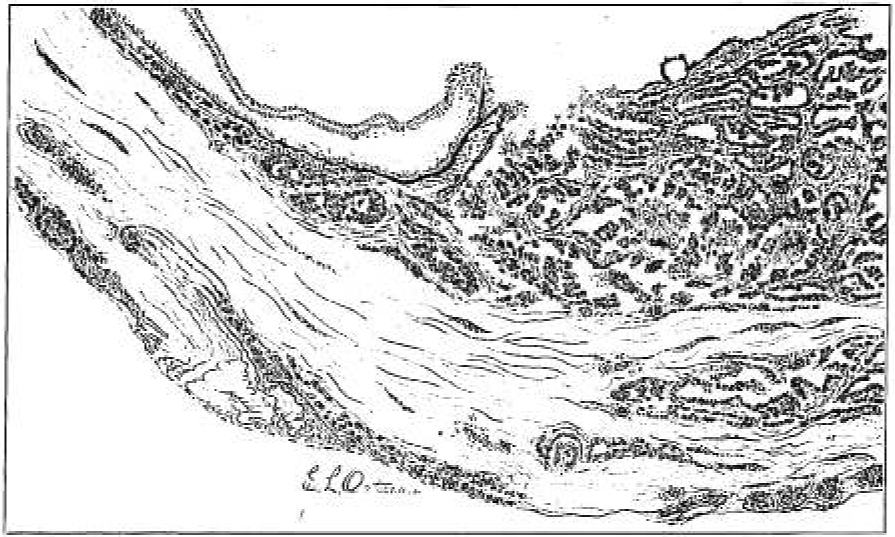
Metastatic carcinoma of the choroid. Lower half of left eye. Horizontal meridinal section, somewhat below the axis. Actual size. (From an original drawing by the author.)

FIG. 2.



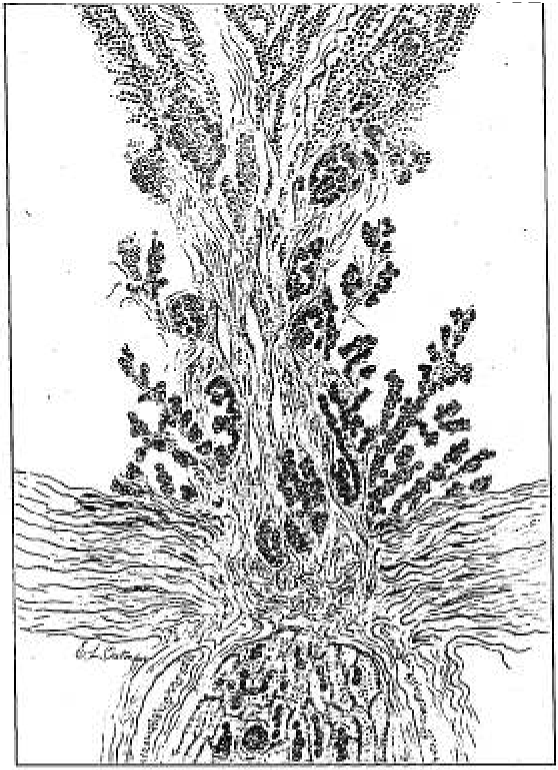
Papillary-cyst-adenocarcinoma of the choroid. The stroma contains the bloodvessels and scattered pigment cells of the choroid. The large alveolus above is filled with disintegrating remains of tumor elements. × 500. (From an original drawing by the author.)

Fig. 3.



The carcinomatous growth has reached the ora serrata. Its wedge-like periphery is advancing along the suprachoroidal space. Choroid is lifted and its lymph channels invaded. Retina totally detached, its pigment layer remains on surface of growth. Spherical colloid body beneath the pigment. × 100. (From an original drawing by the author.)

FIG. 4.



Carcinomatous invasion of optic nerve and retina. Degenerated fibres of detached retina form a stroma for the carcinomatous deposit. × 100. (From an original drawing by the author.)

vena vorticosa, the posterior ciliary arteries, or by following the lymph channels around, and in the optic nerve.

At one point a narrow deposit perforated the sclera obliquely, just where a short ciliary artery might enter. I was inclined to believe that this was the channel by which the metastasis entered, but as no remnant of vessel walls could be made out I was unable to assert this for a fact. These extrascleral deposits permitted the cells to enter the lymph spaces beneath Tenon's capsule and to migrate forward and attack the sclera anteriorly from the outside (Fig. 3).

Optic Nerve. Atrophic, and presenting the usual changes of an ascending degeneration. For a distance of 2.5 mm. from the globe it contained numerous scattered carcinomatous deposits located among the nerve fibres. After death the stump of the optic nerve, optic tracts, and chiasm were removed and carefully examined microscopically, but no evidence of carcinoma could be found. This corresponds with the other histories, recurrence of the disease at the site of operation not having been observed in any of the reported cases.

Retina. The detached retina, which was drawn forward from its attachment at the papilla into a leash of thickened neuroglia and nerve fibres, contained many carcinomatous deposits (Fig. 4). Both here and in the optic nerve the proliferation of the neuroglia furnished the stroma. This was beautifully illustrated by Van Gieson's stain, which rendered the retinal stroma brown, while in the choroid and sclera the stroma had the shining red color of connective tissue.

Where detachment had occurred the pigment layer remained with the choroid, and subsequently covered the surface of the growth (Fig. 3).

Vitreous. No remnant of the vitreous remained anterior to the retina. Between the lens and the detached retina, however, was a crumpled structureless membrane which was probably the empty hyaline sac and remnants of vitreous bands. This was the gray mass observed with the ophthalmoscope during life.

Iris and Ciliary Body. The iris showed the usual changes of plastic iritis, with extensive posterior synechiæ. The filtration angle was narrow, and the region of Schlemm's canal was closely packed with round cells. The near approach of the invading elements had excited the greatest activity in the ciliary body, as shown by the engorged bloodvessels, proliferation of connective tissue elements, and round-cell infiltration.

Cornea. Clear and free from pathological changes.

Lens. Normal, except the capsular thickening at the point of iritic adhesions.

Perhaps our subject cannot be better presented than by first submitting the following extracts from published cases, followed by such conclusions as we are able to draw from their analysis. Thirty-four cases have been collected that justly or unjustly can lay claim to be considered in a review of this subject. As we consider four of them open to doubt, they have not been included in the list of cases, but are discussed in separate abstracts.

Case 1.—M. Perls[1] (Giessen). Male, aged forty-three years. *Primary growth*—carcinoma of right lung; pain in lung for three months. Cachectic. Left eye first affected, then right eye. No operation. Cause of death, carcinomatosis; probably the immediate cause was cerebral metastases. *Autopsy*—metastases in liver, brain, and other organs. *Anatomical and microscopic examination of the eye*—nodular thickening of both choroids posteriorly; more advanced in O. S.: medullary carcinoma; choroid formed stroma for carcinoma; found carcinomatous cells in chorio-capillaris; right retina detached and perforated by small deposits. *Remarks*—published as case of carcinoma of the lung. Eye history not given. Became delirious and died twenty-four days after coming under observation.

Case 2.—J. Hirschberg[2] (Berlin). Berlin Medical Society, 1882. Female, aged thirty-three years. Had carcinoma of right breast nine years before. Right eye first affected, then left eye. O. D. vision lost very rapidly. O. S. became blind in three months. *Ophthalmoscopic appearance*—O. D., yellowish thickening around nerve, 2 mm. high, fading into healthy fundus; O. S., same as O. D.; thickening 1 mm. high. T. N.; no pain. No operation. *Duration of life*—about seven months after first eye symptoms. No autopsy. *Remarks*—August 15, 1882, vision had been destroyed in O. D. very rapidly. September 15th, scotoma appeared in O. S. In December the patient was blind. She left the clinic and died early in the spring of 1883. Supraclavicular glands were enlarged.

Case 3.—Schoeler and Uhtoff.[3] Berlin Medical Society, 1882. Female, aged thirty-three years. Carcinoma of left breast removed six years before. Right eye first affected, then left eye. O. D. blindness of ten weeks' duration when first seen. O. S. vision lost in about one month. *Ophthalmoscope*—O. D., detached retina. Grayish ring around nerve; swollen papilla; vessels dilated. O. S., pin-head sized; grayish-white dots infiltrating the macula; very rapid growth. O. D. T. + 1. O. S., T. N. No operation. *Duration of life*—thirteen months after first eye symptoms. Cause of death, carcinomatosis. *Autopsy*—metastases in right and left ovaries, right and left cerebral hemispheres, dura and pleura. *Anatomical and microscopic examination of the eye*—O. D., sessile tumor around papilla; O. S., same in the macular region. The diagnosis was melanotic carcinoma. The melanosis observed was probably the pigment cells of the choroid scattered throughout the growth. Carcinomatous cells were found in the bloodvessels. Deposits in right optic nerve and sclera. *Remarks*—case was exhibited at the Berlin Medical Society one week after Hirschberg's case. Schoeler saw refraction change in O. S. from —1 D. to + 1 D. in a short time. Vision fell to 8/200 in fifteen days.

Case 4.—J. Hirschberg[6] (Berlin) (second case) and A. Biernbacher (Graz). Female, aged twenty-eight years. Carcinoma of right breast began six years before; was amputated one year before. Very cachectic. Left eye affected. Vision lost very rapidly; no P. L. *Ophthalmoscope*—detached retina; a whitish mass could be seen beneath it. T.—; no pain. No operation. *Duration of life*—two or three months after first eye symptoms. Cause of death, carcinomatosis. *Autopsy*—metastases in lungs, bronchial glands, liver, and kidneys. *Anatomical and microscopic examination of the eye*—tumor extended from papilla to beyond equator; carcinoma simplex; glandular epithelial cells; invasion of retina; finger-like projections between the fibres of the degenerated retina. The growth extended along the suprachoroidal space; scattered pigment in growth; no cells in bloodvessels. *Remarks*—the growth of the tumor was very rapid. The size given in the text is 9 mm. high by 12 mm. broad, but the illustration shows a tumor 9 mm. high by 25 mm. broad. This latter conforms more to the usual form. Enlarged supraclavicular glands.

Case 5.—W. Manz[7] (Frieburg). Female, aged fifty years. Carcinoma of right breast removed three months before. Very cachectic. Left eye first affected, then right eye. Vision lost very rapidly. Yellow reflex behind pupils; extensive detachment of both retinæ. O. D., T. N. O. S., T.—1; pain in O. S. Punctured eye to relieve the pain; not successful. *Duration of life*—ten weeks after first eye symptoms. Cause of death, abdominal metastases. No autopsy. *Remarks*—clinical diagnosis only, but case was undoubtedly genuine. The first eye symptom was a central scotoma ("cloud"). When O. S. was punctured to relieve the pain a thin, yellowish fluid escaped. No relief followed.

Case 6.—A. Schapringer[8] (New York). Female, aged fifty-one years. Adenocarcinoma of right breast amputated two years before. Left eye affected. Vision lost very rapidly. The eye appeared normal externally; pupil slightly dilated, with no reaction to light; media clear; *Ophthalmoscope*—œdema of papilla; in the macular region a reddish-white infiltration; four disks in diameter; elevated + 3.5 D.; scattered pigment; eighteen days later height of tumor was + 4.5 D. T. N. No operation. *Duration of life*—four months after first eye symptoms. Cause of death, exhaustion. *Autopsy*—incomplete; found liver, pulmonary, and other metastases. *Anatomical and microscopic examination of the eye*—discoid tumor in the macular region; scirrhous carcinoma; surface flat; no nodules. *Remarks*—a bony tumor was found growing from the right temporal bone one and one-half inches above the auditory meatus. This is interesting, as in the case reported by Guende[29] four similar growths were found on the skull. Had pleurisy, with effusion.

Case 7.—Johann Mitvalski[5] (Prag). In Norris and Oliver's *System*, vol. iii., p. 546, Schoebl describes this case. Female, aged forty-six years. Carcinoma of left breast amputated two years before. Good health since breast was removed. Left eye affected. Vision lost in two weeks from onset (Schoebl[14]). *Ophthalmoscope*—oval growth; three disks in diameter, extending from papilla to macula; dirty yellow color; scattered pigment; fades into healthy fundus; in two weeks there was extensive detachment of retina. T. N. later; T.—later; T + 2; glaucoma. Enucleation for glaucoma. *Duration of life*—two months after enucleation, and three and one-half months after the first eye symptoms. Cause of death, brain and lung metastases. No autopsy. *Anatomical and microscopic examination of the eye*—"shell-shaped" growth around papilla, extending to ciliary body on the temporal side; all of choroid invaded except upper and inner third; greatest thickness 2 mm.; carcinoma simplex; scirrhous type; pigment in stroma; large spaces; carcinoma spread along the suprachoroidal space. *Remarks*—Mitvalski attributes the large cystic spaces found in the growth to blocking of vena vorticosa. Then hemorrhage forms a clot, carcinoma grows around the clot, thus forming a cystic cavity. This theory is discussed in the text of the present article. Supraclavicular glands were enlarged.

Case 8.—Johann Mitvalski[5] (Prag). Male, aged thirty-five years. Carcinoma of left breast; one year duration; removed seven months before. Left eye affected. Vision lost very rapidly. *Ophthalmoscope*—flat, oval deposit in the macular region; four disks in diameter; central elevation, 3 D.; dirty yellow color; whitish patches; scattered pigment. T. N. No operation. *Duration of life*—two months after the first eye symptoms. Cause of death, brain metastases. No autopsy. *Remarks*—clinical diagnosis only, but it was unquestionably a true case of metastatic carcinoma of the choroid. Enlarged supraclavicular glands.

Case 9.—Gayet[9] (Lyon). Male, aged thirty years. Primary growth; carcinoma of stomach and liver. Good health. Right eye affected. Vision lost very rapidly. Nothing apparent, but extensive detachment of retina. T. + 3; severe pain. Enucleation. *Duration of life*—very short time after first eye symptoms and enucleation. Cause of death, cerebral metastases (?). *Autopsy*—metastases in brain, lungs, liver, and stomach. *Anatomical and microscopic examination of the eye*—discoid tumor near optic nerve; adenocarcinoma of the choroid; cylindrical epithelium. *Remarks*—patient in "good health;" had rapid loss of vision; diagnosis intraocular growth; enucleation; patient became rapidly cachectic; was seized by violent pain in the head, and expired very suddenly. Gayet published this as a case of adenoma of the choroid, but it is obvious that this was a metastatic carcinoma of the choroid.

Case 10.—A. E. Ewing[10] (St. Louis, Mo.). Female, aged thirty-two years. Primary growth; carcinoma of left breast the size of an apple; refused operation. Emaciated. Right eye first affected, then the left eye. O. D. vision lost in two mouths; O. S. vision sank to 20/200 in two or three weeks. O. D., small red tumor in anterior chamber attached to iris, extending to the ciliary body; anterior chamber shallow; detachment of retina; aqueous clear; O. S., extensive detachment of retina below. O. D. T. + 1. O. S. T. + 1 O. D. enucleated. *Duration of life*—about one year after first eye symptoms and enucleation. *Anatomical and microscopic examination of the eye*—discoid tumor lining choroid, surrounding the nerve, extending to the ciliary body on the temporal side: periphery of tumor thin; invasion of iris and ciliary body; diameter of growth 30 mm.; central elevation 1.5 mm.; carcinoma simplex. *Remarks*—O. D. wound healed kindly after enucleation; one month later vision began to fall in O. S.; tumor was now discovered in the breast. She was seen again six weeks after this, and had extensive detachment of retina. Health failed rapidly after enucleation, and Dr. Ewing expressed surprise that she could live with such extensive metastases. Yet Professor Voelkers writes to Dr. Ewing that she survived for about a year. She developed abdominal tumors and carcinoma of the liver. (Personal correspondence.)

Case 11.—O. F. Wadsworth[11] (Boston). Female, aged forty-six years. Carcinoma of right breast amputated sixteen months before. Good health. Right eye affected. Vision lost in one month. *Ophthalmoscope*—macular tumor; sharply defined edge; light color; highest in the centre; retina detached below. Enucleation. *Duration of life*—a year or more after first eye symptoms and enucleation. *Anatomical and microscopic examination of the eye*—to the temporal side of nerve a discoid growth; medullary carcinoma; diameter, 12 mm.; height in centre, 3 mm.; rounded edges. *Remarks*—Dr. Wadsworth lost sight of the patient; believes she lived a year or more after enucleation. (Personal correspondence). For diagnostic purposes, aided by the ophthalmoscope, Dr. Wadsworth passed cataract needle into eye and pressed against tumor, which was hard and resisting. Eye was enucleated at patient's request.

Case 12.—S. Schultz[12] (Frankfort-on-Oder). Female, aged thirty-four years. Carcinoma of right breast for one year. Left eye affected. Externally eye appeared normal; detachment of retina above and on temporal side. T. N. Enucleation. *Duration of life*—thirty-eight days after enucleation and four months and one week after first eye symptoms. Cause of death, bulbar paralysis. *Anatomical and microscopic examination of the eye*—two deposits, one above the optic nerve on the temporal side, another below the nerve; first was 19 mm. broad by 5 mm. high; second was 5 mm. broad and 2 mm. high; medullary carcinoma; commencing perforation of sclera posteriorly. *Remarks*—had pain around eye with minus tension; pain followed the distribution of trigeminus.

Case 13.—A. Elschnig[13] (Graz). Female, aged fifty-seven years. Carcinoma of left breast removed ten months before. Left eye affected. Very rapid loss of vision. Externally the eye appeared normal. *Ophthalmoscope*—retina detached above and below the nerve; became complete in a short time; fovea, dark red color; later the eye presented a glaucomatous appearance. T. +; painful. No operation. *Duration of life*—fifteen weeks after first eye symptoms. Cause of death, carcinomatosis. *Autopsy*—metastases in brain, lungs, and liver. *Anatomical and microscopic examination of the eye*—discoid tumor surrounding the nerve, principally on the temporal side; scirrhous carcinoma; choroid infiltrated and about twice normal thickness for 13 mm. around nerve; carcinomatous cells found in bloodvessels; retrograde metamorphoses in older portions of growth; iris adherent to cornea at filtration angle. *Remarks*—had paralysis of left recurrent laryngeal nerve; became comatose before death.

Case 14.—Uhtoff[14] (Berlin) (second case). Female, aged forty-seven years. Carcinoma of right breast amputated nine months before. Left eye first affected, then right eye. Very rapid loss of vision. *Ophthalmoscope*—grayish-yellow elevation; whitish spots; O. D. height + 7 D.; O. S. height + 9 D. No operation. *Duration of life*—six weeks after first eye symptoms. Cause of death, carcinomatosis. *Autopsy*—metastases in right temporal lobe, liver, spleen, kidney, bronchial and retroperitoneal glands, lung, and right suprarenal. *Anatomical and microscopic examination of the eye*—shell-shaped deposits posteriorly on temporal side; scirrhous carcinoma; large spaces full of necrotic tissue, in which cells can be outlined by careful focusing; retrobulbar perforations of the sclera. *Remarks*—died forty-four days after entering the hospital; was insane; became totally blind before death.

Case 15.—W. A. Holden[15] (New York). *Anatomical and microscopic examination of the eye*—three separate deposits on temporal side; discoid tumor; diameter, 12 mm.; thickness, 1.5 mm.; small episcleral deposit at same point, but not connected; slight infiltration of choroid 4 mm. to the nasal side of the optic nerve; retina detached from papilla to ora serrata on the temporal side; cells in the capillaries and in the large veins of the choroid. *Remarks*—clinical history of case was lost.

Case 16.—S. Schultz[16] (second case). Female, aged thirty-nine years. Carcinoma of right lung of six months' duration. Cachectic Left eye affected. Vision lost in six weeks. Externally the eye appeared normal; behind the pupil could only see a vascular membrane, the detached retina. Very painful. Enucleation. *Duration of life*—four months after enucleation and seven months after first eye symptoms. Cause of death, marasmus. No autopsy. *Anatomical and microscopic examination of the eye*—discoid tumor on temporal side of the nerve; extra-scleral growth posteriorly; tumors, diameter 20 mm., height 3 mm.; extra-scleral growth 6 mm. by 4 mm.; connected by perforation of sclera; found a posterior ciliary artery plugged with epithelial cells; scirrhous carcinoma; hemorrhages in cell nests; no cells found in bloodvessels of choroid, but they were found in scleral bloodvessels; pigment in choroidal stroma; no pigment in scleral stroma. *Remarks*—the observations regarding the pigment found in these tumors is of value as showing that it is only the normal pigment of the choroid and retina which has been distributed by the growth, and that no reason exists for calling them "melanotic carcinomas."

Case 17.—V. Kamocki[17] (Warsaw). Male, aged thirty-seven years. Malignancy was not suspected. Best of health. Right eye affected. Vision was lost when first seen. Externally the eye appeared glaucomatous; detached retina closely applied to posterior surface of lens; much darker than usual; no wavy motion. T. +; very painful. Enucleation. *Duration of life*—a few weeks after enucleation and one year after first eye symptoms. Died suddenly soon after enucleation. No autopsy. *Anatomical and microscopic examination of the eye*—flat nodular tumor surrounding the optic nerve; diameter, 18 mm.; height, 5 mm.; sharply defined from healthy choroid; nerve invaded; adenocarcinoma; areas of colloid degeneration. *Remarks*—Kamocki had no suspicion of carcinoma, as the patient appeared to be in perfect health; diagnosis was adenoma of the choroid from lacrymal gland structure, congenitally included in the eye; diagnosis was changed when it was learned that the patient died very suddenly a few weeks later, probably from cerebral metastases; very similar to Gayet's case.

Case 18.—H. D. Noyes[18] (New York). Female, aged fifty-five years. Carcinoma of breast removed fifteen years before. Right eye affected. *Ophthalmoscope*—small elevation in macula of + 4 D.; color darker than the surroundings. T. —; pain. Enucleation. *Anatomical and microscopic examination of the eye*—carcinoma simplex; height of tumor, 1.5 mm. *Remarks*—began by rapid increase of hypermetropia from May to June of + 1.5 D. In August first ophthalmoscopic change was seen. I have been unable to secure any further information regarding this case than is to be found in Dr. Noyes' report.

Case 19.—G. Abelsdorf[19] (Berlin). Female, aged forty-four years. Carcinoma of right breast for one year. Left and right eyes simultaneously affected; left more advanced. In three weeks vision reduced to counting fingers. *Ophthalmoscope*—O. D. retina detached over macula; O. S., extensive detachment of temporal side. O. D. T. N.; O. S. T. N. *Duration of life*—three months and three weeks after first eye symptoms. *Anatomical and microscopic examination of the eye*—O. D. and O. S. nearly entire choroid invaded to ora serrata; choroidal deposits 2.5 mm. thick; sharp periphery; scirrhous carcinoma; deposits in iris, ciliary body, optic nerve, and sclera; emboli of epithelial cells in post-ciliary arteries; carcinomatous cells in bloodvessels.

Case 20.—G. H. Matthewson[20] (Montreal). Female, aged forty-eight years. Primary growth. Carcinoma of thyroid. Right eye affected. *Ophthalmoscope*—small, flat, ovoid swelling below nerve; retina detached beneath growth. Posterior sclerotomy for amotio retinæ. Enucleation. *Anatomical and microscopic examination of the eye*—flat, rough tumor below nerve; adenocarcinoma; invasion of optic nerve and sclera. *Remarks*—sclera was punctured for detachment of retina, but fluid re-formed in twenty-four hours; eye was enucleated three months after first eye symptoms; patient was living when case was reported.

Case 21.—C. Devereux Marshall[21] (London). Female, aged fifty-seven years. Scirrhous carcinoma of right breast of seventeen months' duration. Right eye affected. Vision lost in two months. Patient not seen by author. T. N. Enucleation. *Duration of life*—three months after enucleation and five months after first eye symptoms. Cause of death, abdominal metastases. *Anatomical and microscopic examination of the eye*—discoid tumor posteriorly; medullary carcinoma; periphery of growth split choroid like a wedge; optic nerve invaded.

Case 22.—C. Devereux Marshall[21] (second case) (London). Female, aged forty-four years. Breast amputated eighteen months before. Very feeble. Right eye first affected, then left eye. Vision lost in few weeks. O. D.; pupil sluggish. *Ophthalmoscope*—fundus unevenly hypermetropic; gray elevation around nerve; optic nerve lies in depression; veins large, but not tortuous; O. S. appearance same as in right above disk. No pain; O. D. T. N.; O. S. T. N. *Duration of life*—seven or eight months after first eye symptoms. Cause of death, exhaustion. *Remarks*—clinical diagnosis only; the history and course of the disease was typical of carcinoma of the choroid.

Case 23.—Kaemmerer[22] (Erfurt). Female, aged fifty-eight years. Primary growth. Carcinoma of liver. (?) Very cachectic. Right eye affected. Vision lost in a few weeks. O. D.; mydriasis; no pupil reflex to light; blepharitis; corneal opacity; no external inflammation; highly myopic. *Ophthalmoscope*—old choroiditis; optic nerve covered by bluish-white detachment of retina; O. S.; myopia; choroiditis; staphyloma cornea. *Duration of life*—short time after first eye symptoms. Cause of death, exhaustion. *Autopsy*—"diffuse" carcinoma of liver; no nodules; liver contracted; no stroma found microscopically. *Anatomical and microscopic examination of the eye*—O. D.; flat nodular tumor posteriorly, one-quarter area of eye; yellow-gray color; 3 mm. high in centre; some nodules 7 mm. high; sclera invaded; no alveolar structure demonstrable, but found network of elastic fibres; large polygonal cells. *Remarks*—the author found no alveolar structure either in the primary liver growth or in the choroid, and speaks of all deposits as being infiltrations. Carcinoma without any stroma is, however, a difficult diagnosis to digest. The author argues that this carcinomatous infiltration of the liver is evidence of a carcinomatous germ infection. As all the deposits discovered were infiltrations, it raises a suspicion that they were metastases, and that the primary growth was not located.

Case 24.—Wagenman.[23] Female, aged forty-five years. Carcinoma of breast removed one year before. Good health. Right eye first affected, then left eye. Vision reduced to fingers in three weeks. *Ophthalmoscope*—O. D.; tense gray detachment of retina around papilla; height of detachment + 5 D.; O. S.; flat, grayish-white elevation in macula. *Operation*—O. D. enucleated. *Duration of life*—four months after enucleation and five months after first eye symptoms. Cause of death, carcinomatosis. No autopsy. *Anatomical and microscopic examination of the eye*—O. D.; discoid tumor on temporal side and surrounding nerve; sharp demarcation from surrounding fundus diameter, 20 mm.; height, 1 mm.; carcinoma simplex; sclera invaded near vena vorticosa; O. S. not examined. *Remarks*—O. D.; eye trouble commenced with a "glimmering;" O. S.; one month after enucleation of right eye the same "glimmering" appeared in the left eye; became totally blind before death; husband was syphilitic.

Case 25.—Felix La Grange.[24] Female, aged forty-eight years. Carcinoma of breast removed two years before. Right eye affected. Total detachment of retina; tumor in iris. T. + 1; pain. Enucleation. *Duration of life*—two months after first eye symptoms. Cause of death, carcinomatosis. *Anatomical and microscopic examination of the eye*—flat, shell-shaped growth on temporal side of nerve; carcinoma simplex; retina perforated by growth; deposits in iris and sclera; carcinomatous cells in bloodvessels.

Case 26.—JOHN ROWAN.[25] Male, aged fifty-five years. Primary growth. Carcinoma of lung; pain in lung for four months: Cachectic. Left eye affected. *Ophthalmoscope*—O. D.; glaucomatous cupping of disk. O. S.; immobile detachment of retina posteriorly and below. O. D. T. N.; O. S. T. N. *Duration of life*—four and one-half months after first eye symptoms. Died suddenly. *Autopsy*—carcinoma of lung. *Anatomical and microscopic examination of the eye*—discoid tumor of choroid posteriorly; central elevation 4 mm.; scirrhous carcinoma; detached retina extensively invaded. *Remarks*—enlarged cervical glands.

Case 27.—DE SCHWEINITZ[26] and STEELE. Female, aged forty years. Carcinoma of breast amputated six months before. Right eye affected. *Ophthalmoscope*—media clear; flat, broad, grayish-yellow thickening in macular region: edges of infiltration thin; central elevation + 6 D.; periphery level with fundus. T. N. Eye was enucleated. *Duration of life*—thirteen weeks after enucleation and sixteen weeks after first eye symptoms. Cause of death, brain metastases. *Anatomical and microscopic examination of the eye*—carcinoma simplex; size of growth, 14 mm. broad, 2 mm. thick; very large alveoli with necrotic foci; vessels plugged by carcinomatous cells. *Remarks*—recurrence of growth in breast, clavicular, cervical, and axillary glands.

Case 28.—CH. BENTZON.[27] Male, aged thirty years. Primary growth. Carcinoma of a dermoid cyst in right suprarenal body. Right eye affected. Vision lost in two months. When first seen it was supposed to be choroiditis centralis extending from macula to the disk; later an extensive detachment of retina occurred. Early intermittent attacks of pain. *Duration of life*—seven months after first eye symptoms. Cause of death, carcinomatosis. *Autopsy*—carcinoma of right suprarenal, right and left lungs, and mediastinal glands. *Anatomical and microscopic examination of the eye*—greenish-white mass, involving entire O. D.; posterior half of eye was lost; choroid and ciliary body replaced by papillary adenocarcinoma with very large acini. *Remarks*—father died from carcinoma of the rectum. The history indicates that glaucoma developed. First symptom was central scotoma. Became blind in eight weeks.

Case 29.—W. C. ROCKLIFFE.[28] Female, aged forty-six years. Primary growth. Scirrhous carcinoma of the breast. Left eye first affected, then the right eye. In one month vision in O. S. was reduced to fingers. *Ophthalmoscope*—O. S.; four cyst-like retinal detachments below the disk, bulging into vitreous; optic neuritis; hemorrhages into disk. O. S. T. + ;? severe pain; O. D. T. N. O. S. enucleated. *Duration of life*—twenty weeks after enucleation and about nine months after first eye symptoms. Cause of death, carcinomatosis. *Anatomical and microscopic examination of the eye*—O. S.; flat tumor, extending from nerve to ciliary process; height at nerve, 2 mm.; the growth split the choroid, which covered it on each side; scirrhous carcinoma; optic nerve and sclera invaded. *Remarks*—pain with a doubtful tension. Papillitis was marked, and detachment occurred close to the nerve before deposits could be seen with the ophthalmoscope. This history suggests a possible invasion *via* the arteria centralis retinæ.

Case 30.—E. L. OATMAN (Brooklyn, N. Y.). Male, aged fifty-six years. Primary growth. Carcinoma of liver. Apparently in good health. Left eye affected. Vision lost in six weeks. When first seen the eye had become glaucomatous; posterior synechia; gray, non-vascular, smooth mass closely applied to posterior surface of lens. T. + 1; very painful. Enucleation. *Duration of life*—thirty-five days after enucleation and eighteen months after first eye symptoms. Cause of death, carcinomatosis; pneumonia. *Autopsy*—metastases in right lung and right bronchus, right suprarenal, right and left kidneys, spleen, bronchial and retroperitoneal glands; falx cerebri; tentorium cerebelli pia mater. *Anatomical and microscopic examination of the eye*—papillary cyst; adenocarcinoma. (See text.) Remarks—(see text).

Decision as to the apocryphal character of the following cases must be left to the judgment of the reader.

I more than suspect that the following case was one of metastatic carcinoma of the choroid, although not so considered by the author.

Reported by Ch. Guende.[29] Female, aged fifty-four years. Tumor of right breast, supposed by Guende to be carcinoma, although a fragment removed for microscopic examination did not yield satisfactory results. She was very cachectic. Had four "nut-sized" bony growths on the skull. Many painful nodules on the sternum. Vision of O. D. had been failing for nine months. Six months before coming under observation she received a blow in this eye from an umbrella, which excited violent reaction. Recurring attacks of cyclitis followed. Tension was minus, but pain was intolerable. With the ophthalmoscope he saw a yellowish-gray tumor, with scattered pigment spots, 2 mm. high, its border fading into the surrounding fundus. The retina was detached below the growth. This describes a carcinoma. It is very curious that in Schapringer's[8] case (Case 6), which was unquestionably carcinoma, there was a bony tumor on the skull one and one-half inches above the right ear.*

Guende followed the case no further, but ventures a diagnosis so remarkable that no efforts should have been spared to confirm it, namely, that this patient had carcinoma of the breast, and coincidently a sarcoma of the choroid.

Carl Wagner.[30] Male, aged forty-five years. Tumor of liver and stomach. Had been blind in left eye for eighteen months. Eye became glaucomatous; with the ophthalmoscope a "pea-sized" tumor was seen on the *nasal side at the equator.* Died soon after enucleation. Eye symptoms had existed for two years before death. The choroidal tumor was 2 mm. high, and was diagnosed by the author, who examined it microscopically, as a carcinoma. Metastases were found in the stomach, liver, and in the glands of the axilla, neck, and groin.

The long duration of the eye symptoms is suspicious. In no other case which has ever been reported was a carcinomatous metastasis deposited in the choroid as far forward as the equator. The other metastases suggest primary sarcoma of the eye. We have in addition the positive statement of S. Schultz,[16] who examined a section of this tumor, that it was a large round-cell sarcoma.

Samelsohn[31] briefly mentions a case which he considers to be metastatic carcinoma of the choroid, and promises a full report of the case later. Patient was a woman with carcinoma of the breast and pleura. Difficulty of vision had existed for two years. She had an intraocular tumor which had extended to the orbit. I have omitted this case without intending to question the well-known accuracy of the author's powers of observation, but simply because the preliminary report is so incomplete that no opinion can be based upon it. Possibly in a later paper, which has escaped my notice, he has verified the diagnosis.

Schoebl,[32] in his masterly contribution, "Diseases of the Retina," describes two cases of carcinoma of the choroid. The first is probably Case 7 of my table, reported by Mitvalski.[5] The second case is open to discussion. In 1881 Schoebl found a pigmented tumor of the cornea. Two years later he discovered a choroidal deposit surrounding the nerve. His clinical diagnosis was sarcoma, but the microscopic examination of the corneal growths showed a stroma containing epithelial cells, and the diagnosis of carcinoma was based on this. Schoebl very justly pronounces this case unique. My reasons for questioning this conclusion, aside from the age of the patient and the pigmentation of the growth, is the fact that it originated in and was confined to the connective tissue elements of the cornea, namely, the substantia propria. Schoebl emphasized the fact that Bowman's and Descemet's membranes were not involved. Modern pathology does not permit carcinoma to originate in connective tissue. Alveolar sarcoma or endothelioma would probably be a safer diagnosis. Whatever its histological character, it was a case of extreme interest.

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* Probably growing along the squamous suture.

This leaves thirty cases which may be accepted as probably genuine. In twenty-six a microscopic examination confirmed the diagnosis. The ages of the patients range from thirty to fifty-eight years, the average being 44.37 years. Twenty of the primary growths were situated in the breast, three in the lungs, two in the liver, one in the stomach and liver, one in the thyroid, and one in a dermoid cyst of the suprarenal body. In two cases—Holden's[16] and Kamocki's[17]—carcinoma not being suspected until after the histological examination of the eye, the patients passed from under observation, and the primary growth was not located. Twenty-two of the cases were females and seven were males. Although we have three females to one male affected, I am inclined to believe that this is not so much due to influence of sex as to the greater frequency of carcinoma of the breast in women, our statistics showing that the majority of eye metastases originated in carcinoma of the breast. It is of interest to note that in one male[5] (Case 8) the primary growth was in the breast. In every case so far reported the deposit commenced in the posterior portion of the choroid over the point of entrance and distribution of some one of the short ciliary arteries. The exact location is described as on the temporal side of the nerve in eighteen cases, above the nerve in one case, below the nerve in one, and around the nerve in two.

In all stages of carcinoma the cells exhibit a marked preference for the lymph channels as a route of emigration. Yet when the disease is far advanced the bloodvessels also are undoubtedly employed for this purpose. As we know of no lymph currents that could convey the cells from an abdominal or thoracic carcinoma to the eye, it may be assumed that they are brought hither by the vascular system. Consequently we can understand why the macular region of the eye would be the destination of am embolus seeking the easiest and most direct route from the heart to the choroid, namely, by way of the common carotid artery, and subsequently leaving the ophthalmic artery by one of the branches which enter the temporal side of the globe.

I am unaware of any case in which malignant disease has invaded the eye by way of the arteria centralis retinæ. Dittrich,[33] Krahm,[34] Elschnig,[35] and Holden[36] have reported cases of metastatic carcinomatous deposits in the optic nerve. In every case, however, the neoplasms were located in the neural sheaths and infiltrated between the fasciculi of the nerves. The central vessels were filled with blood or occluded by a contiguous extension of the growths, the primary route of invasion being from the brain outward along the lymph channels.

An analysis of the early cases led observers to the conclusion that the left eye was more frequently invaded than the right, for the reason that a cardiac embolus enters by preference the left common carotid artery. Our table, however, tends to disprove this theory, as it shows that twenty right eyes and nineteen left eyes were attacked. Holden[15] (Case 15) does not state in which eye the deposit occurred. Both eyes were involved in ten, or one-third of all the cases.

No satisfactory explanation has as yet been offered of the fact that when this extremely rare metastasis occurs in one eye the other eye is peculiarly liable to a similar invasion.

Ten of the thirty cases here tabulated were bilateral.* Had the duration of life been longer in these cases it is reasonable to suppose that this percentage would be much higher. The theory of Manz and Wagner, that the cells travel from one eye to the other along the lymph channels of the optic nerves, is untenable, for, as Schultz[16] points out, if this were true, the metastasis would develop in the papilla—a condition which has never been observed. On the contrary, the site of its appearance in the second eye is analogous to that in the first, namely, at the point where a short ciliary artery enters the eye. In two of our cases —Ewing's[10] and Wagenman's[23]—the disease made its appearance in the second eye a month after the first had been removed.

Carcinoma is at present a subject of the most active investigation, and it is possible that we may be forced to modify our present views regarding its etiology and methods of systemic dissemination. Whatever the materies morbi may be—lawless cells or protozoa—we may assume from the wide distribution of secondary deposits that, in its advanced stage, it invades the entire system of its victim, subjecting all parts to its influence; yet the unknown factor which determines the location of a secondary deposit spares the organ of vision in all but the rarest cases. If the choroid owes its usual exemption from secondary carcinomatous deposits to the anatomical fact that it is a remote and inaccessible region, and that a carcinomatous embolus reaches it only rarely and by chance, then why, when it occurs in one eye, should the second eye, which is equally remote and inaccessible, be subjected to the same rare accident in one-third of all cases? It is difficult to understand why an unusual accident occurring to one eye should predispose its fellow to the same misfortune. The only explanation that offers itself to my mind is the assumption that the choroids are usually protected from the development of secondary carcinomatous deposits by conditions other than mere anatomical inaccessibility, and that when such a deposit does occur it is not due to chance, but rather to the fact that the unknown conditions which nearly always prevent infection are now suspended and fail to afford protection, thus leaving not only one but both choroids vulnerable and in a favorable condition for the growth of the carcinomatous processes. *A priori*, both are affected in one-third of all the cases.*

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* Holden's case[15] is necessarily omitted because it has no clinical history.

The shape and method of growth of these tumors is very characteristic. The almost universal type is a flat, disk-shaped thickening of the choroid, highest in its centre, which is usually in the macular region and sloping off to a thin-edged periphery. The tendency is to spread laterally, thus differing from sarcoma, which grows forward into the vitreous, forming a protuberant mass.†

As carcinoma and sarcoma possess no inherent tendency to this difference in form, the occurrence of such morphological variations in the eye can be best explained by assuming that it is due to environment. Sarcoma is primary in the choroid, originating in the walls of its blood-vessels. It is a growth of the fixed tissues of the eye, circumscribed, and of comparatively slow development. It naturally meets with the least mechanical resistance to its growth by pushing out into the vitreous.

As the choroid possesses no epithelial structures from which a carcinoma could develop, its presence here is always metastatic. It is in the nature of an infiltration by foreign elements, namely, epithelial cells, into the sponge-like lymph spaces of the lamina suprachoroidea, and along the perivascular and other lymph channels.‡

These cells naturally follow the path of least resistance, namely, laterally from the original foci. In rare instances a rapidly growing carcinoma in an advanced stage may reach a considerable height, as in Hirschberg's case,[6] where the elevation was 9 mm. This, however, was found post-mortem, and has no clinical significance.

Although the development of a choroidal carcinoma is much more rapid than a sarcoma, yet, judging from the reports, a small carcinomatous deposit produces far more extensive detachment of the retina than does a central sarcoma of equal size. The explanation for this may be found in the different histological structures of the two growths, a sarcoma, as we know, being a connective tissue formation, while the cells of a carcinoma of the choroid are always of the glandular epithelial type, possessing an abortive function whose perverted secretion may assist in detaching the retina. Griffith[37] calls attention to the fact that central sarcomas in their early stages are often unattended by any subretinal effusion; but this does not hold true of sarcomas situated near the equator, which naturally interfere with the large emissary veins. The writer's view is that the subretinal effusion which attends sarcoma of the choroid is in a measure produced mechanically by interference with the circulation, while in carcinoma the early effusion is in part at least an exudate from the tumor itself.*

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* It is worth noting that in Uhtoff's case both ovaries and both cerebral hemispheres were affected. In Bentzon's case both lungs, and in my case both kidneys.

† The rare spindle-cell sarcoma of the choroid is usually a sessile tumor. I have never seen one assume the disk shape common in carcinoma. The only exception to this form is a case of sarcoma mentioned by Griffith[27] (case of Dr. Little), in which the growth assumed a "cake-like" form similar to carcinoma. Griffith ventures the opinion that had it been possible to obtain an ophthalmoscopic view the diagnosis of sarcoma would not have been made. Although I have no intention of questioning the diagnosis in this case, I have seen a case of chronic inflammatory thickening of the choroid assume exactly this form and organize into a cellular structure so closely resembling sarcoma microscopically as to deceive far abler observers than myself.

‡ Although cells have been found in the capillaries, the principal development of carcinoma is not in the lumen of bloodvessels but in lymph spaces.

In Case 34, by Rockliffe,[28] the patient, although under constant observation, had detachment of the retina before the deposit could be seen ophthalmoscopically.

The time from the first eye symptoms until vision is reduced to counting the fingers is measured by weeks instead of by months or years, as is the case in sarcoma. Schoeler[3] gives the time as one month; Mitvalski[5] (Schoebl[32]), two weeks; Ewing,[10] two or three weeks and two months; Wadsworth,[11] one month; Schultz,[16] six weeks; Abelsdorf,[19] three weeks; Marshall,[21] two months; Wagenman,[23] three weeks; Bentzon,[27] two months; Rockliffe,[28] four weeks; Oatman, six weeks. The others are less exact, but generally speak of the vision as being lost "very rapidly."

The tension of forty-one eyes is described as normal in sixteen, increased in eleven, diminished in three, and not recorded in eleven. In Case 7, Mitvalski,[5] the tension was at first normal; later it was slightly minus, but soon afterward it increased, and the eye became glaucomatous.

Devereux Marshall[36] has studied the question of tension in intraocular growths, and his conclusions, which are evidently sound, show that in sarcoma confined to the choroid alone the tension is increased in about two-thirds and normal in about one-third of the cases, but is rarely if ever decreased. In carcinoma, as is shown by the preceding abstracts, these figures are reversed, about one-third having increased and two-thirds normal or possibly diminished tension. Still I am inclined to believe that a carcinomatous eye would enter the glaucomatous stage as frequently as one affected with sarcoma were its progress not arrested by the early death of the patient.

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* It is not the writer's intention to advocate any of the various opposing theories that more or less imperfectly attempt to account for all cases of amotio retinæ in intraocular tumors, but the disproportionately large detachment which attends carcinoma in its *early stages* requires explanation.

About the only conclusion to be drawn from these observations is that an intraocular growth limited to the choroid and with minus tension is not a sarcoma.*

Although much labor has been expended in the study of tension in intraocular growths, too much reliance should not be placed upon it in differential diagnosis, as its variations probably depend on conditions other than the histological structure of the growth.

There is great uniformity in the following descriptions of the ophthalmoscopic pictures of early carcinomatous deposits by those observers who have been so fortunate as to obtain an examination before detachment of the retina had obscured the view.

It must be borne in mind that these descriptions are by different observers of different cases.

Case 2, by Hirschberg.[2]—O. D. Small, round, yellowish deposits around the papilla; central elevation 1.5 mm., fading off into the surrounding normal fundus. O. S. presented the same picture; central elevation, 1 mm.

Case 3, by Schoeler[3] and Uhtoff.—O. D. Retina was detached, but a grayish-white ring could be distinguished encircling the nerve. O. S., grayish-white, pinhead sized deposits in the macular region. The refraction changed from — 1 D. to + 1 D. while under observation.

Case 6, by Schapringer.[8]—In the macular region a reddish-white discoloration, with scattered pigment. Central elevation + 3.5 D.; slight detachment below the growth; eighteen days later the elevation was + 4.5 D.

Case 7, by Mitvalski.[5]—Oval growth on temporal side of nerve, fading off into the surrounding fundus; dirty-yellow color, with scattered pigment.

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[*] Marshall[39] also has a later paper on the same subject, which tends to confirm his previous conclusions. It is interesting in this connection to direct attention to a paper by Casey Wood[40] and Brown Pusey on primary sarcoma of the iris which rather tends to disprove Marshall's conclusions. Sixty-three cases are tabulated, in many of which the ciliary body was involved. The tension in twenty-five cases is mentioned as plus in thirteen, normal in eleven, and minus in one.

Devereux Marshall's[38] tables, compiled from cases more or less under his personal observation, are as follows:

Sarcoma of the choroid . . . . 53 cases.
Tension was + in 36 = 67.72 per cent.
Tension was N in 16 = 30.18 per cent.
Tension was — in 1 = 1.88 per cent.

Marshall doubts the accuracy of observation in the single case with diminished tension.

Sarcoma of the iris and ciliary body . . . . 28 cases.
Tension was + in 10 = 35.71 per cent.
Tension was N in 14 = .50 per cent.
Tension was — in 4 = 14.28 per cent.

Glioma of the retina . . . . 19 cases.
Tension was + in 7 — 36.84 per cent.
Tension was N in 10 — 52.63 per cent.
Tension was — in 2 — 10.52 per cent.

Case 8, by Mitvalski.[5]—Flat, oval elevation in the macular region; central elevation, 1 mm.; dirty yellow color, with whitish patches and scattered pigment spots.

Case 11, by Wadsworth.[11]—Sharply-defined macular tumor, highest in the centre, and sloping to the periphery; light in color; retina detached below.

Case 15, by Uhtoff.[14]—O. D. Yellowish-gray elevation, with whitish spots; central elevation + 7 D. O. S. presented the same picture on the temporal side of the nerve. Central elevation was + 9 D.

Case 22, by H. D. Noyes.[18]—Hypermetropia increased to + 1.5 D. in one month; two months later H. = + 4 D., and a small elevation darker than its surroundings was seen in the macula.

Case 24, by G. H. Matthewson.[20]—Small, flat, ovoid swelling below nerve. Extensive detachment of the retina.

Case 26, by Marshall.[21]—Fundus elevated around the nerve; red reflex lost; nerve was not choked. No hemorrhages noticed.

Case 28, by Wagenman.[23]—O. D. Flat, grayish-white elevation under the detached retina in the macula region. O. S. Flat, grayish-white tumor in the macular region.

Case 32, by de Schweinitz.[26]—Broad, flat, greenish-yellow deposit in the macular region. Height in the centre + 6 D. Periphery level with the fundus.

Case 33, by Bentzon.[27]—When first seen was diagnosed as central choroiditis. Eight weeks later the retina was extensively detached.

Case 34, by Rockliffe.[28]—This case presented a picture different from all the others. There was optic neuritis, with hemorrhage into the nerve, and four cyst-like detachments bulging in the vitreous.* As the case was under continuous observation it appears that the retina was detached before the deposits were visible to ophthalmoscopic examination.

The prognosis is, of course, bad, and the duration of life but brief. The average time from the first eye symptoms to death, as estimated from twenty-four cases, was about six and one-half months. The greatest expectation of life cannot reach two years. The usual cause of death is general carcinomatosis.

The subject of diagnosis of an intraocular growth, attractive as it is, should not be discussed here, but only such points as may serve to differentiate carcinoma from other conditions, notably sarcoma. Although it would not appear impossible to recognize a carcinomatous deposit ophthalmoscopically without knowledge of a pre-existing growth elsewhere in the body, I believe it has never been done. Carcinoma of the choroid is always a secondary deposit. Whether a sarcoma in the eye is ever secondary remains unsettled.

A few cases have been reported as such, and belief in its occurrence is proclaimed by some of our best observers. Schultz[16] accepts Braem-

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[*] Papillitis appears to have been unusually pronounced in this case. Invasion *via* the arteria centralis retinæ would be unique. We trust that this point was investigated in the examination.

ser's[41] case without microscopic evidence; de Schweinitz[42] reports a case of his own;* but none are free from criticism.

Fuchs,[43] however, states dogmatically that metastatic sarcoma of the choroid is unknown, although he does not deny that it can occur. He collects 259 recorded cases of sarcoma of the choroid, none of which was secondary. In one case the tumor had existed in a blind, atrophic eye for twenty years, the patient succumbing at last to a metastatic deposit in the heart. It should not be forgotten that a peripherally situated sarcoma may remain in the eye for a long time without attracting the attention of the patient. The conditions necessary to establish the diagnosis of a metastatic sarcoma of the choroid are *the development of sarcoma in an eye known to be previously healthy in a person with a pre-existing sarcoma.* These conditions, so far as the writer's information extends, remain unfulfilled.

Carcinoma always appears posteriorly, usually in the macular region. It is a flat and disk-shaped infiltration beneath the retina, and its periphery, in the early stages at least, is level with the surrounding fundus. A sarcoma may be flat when very young, but it grows slowly forward into the vitreous as a rounded protuberance. Carcinoma is described as having a dirty yellow or whitish color, with scattered pigment. Sarcoma ranges from yellow to brown or black. No observers have mentioned that the carcinomatous growth appeared vascular. The overlying retina is usually described as œdematous or slightly detached. Sarcomas, on the contrary, often appear quite vascular. Carcinoma appears later in life than sarcoma. In sarcoma confined to the choroid alone, the tension is not diminished. (Marshall).

The pain of sarcoma is due to increased tension. In carcinoma it may be severe, with normal or diminished tension. (Noyes,[18] Schultz,[16] Bentzon,[27] and Rockliffe.[28]) A positive central scotoma is the usual initial symptom, but a rapid increase of hypermetropia, without any marked ophthalmoscopic changes, may occur, as in Noyes' case. When Schoeler[3] exhibited his case before the Berlin Medical Society in 1882, Hirschberg and Schweigger doubted the diagnosis, because no difference could be observed in the level of the fundus. But Schoeler said, however, that the choroid was diffusely thickened, and that the refraction had changed from — 1 D. to + 1 D. while under his observation. Uhtoff examined the eye post-mortem and found a carcinomatous choroid. The clavicular or cervical glands may or may not be enlarged. As this is an inconstant symptom, evidently depending on deposits located elsewhere than in the eye, its diagnostic value is only confirmatory as suggesting a carcinomatous diathesis.

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* de Schweinitz's case, if rigidly construed, may be accepted as a secondary invasion of the choroid by sarcoma. A man died from primary mediastinal sarcoma twenty-four hours after coming under observation. Necropsy showed extensive sarcomatous invasion of the optic nerves and orbital contents sufficient to produce marked exophthalmos. Only the posterior halves of the eyes were examined microscopically. Small areas of deep choroidal infiltration, with sarcoma cells, were found on the nasal sides of the optic nerves. In this case the eyes appear to have been invaded more by a contiguous extension from the optic nerves or orbital deposits than by a metastasis as generally understood. It must also be remembered that an insignificant choroidal sarcoma may produce fatal metastases.

A central conglomerate tubercle of the choroid may occur without any external inflammation of the eye, and it may not always be possible to locate other tubercular foci. It also may occur in subjects past middle life, but it differs from carcinoma by its rounded, protuberant form, the presence of satellite tumors, and a tendency to soften and perforate the sclera. Increase of tension is very rare in tuberculoma.

Detachment of the choroid, miliary tuberculosis, and choroiditis posticum could hardly be confounded with carcinoma by trained observers.

It must be borne in mind that the physical condition of the patients may not suggest the presence of malignant disease. In seven of our tabulated cases their good health was especially mentioned, and in many of the others it may be inferred from their histories.

All treatment is, of course, unavailing. The almost universally accepted rule that an eye should be enucleated as soon as the diagnosis of carcinoma of the choroid is made may be questioned. The late Henry D. Noyes[18] advised against subjecting these doomed patients to the ordeal of an operation unless rendered necessary by pain. His reasons were to spare suffering in a case where an operation could not hope to prolong life.

If the eye is painful or has entered the glaucomatous stage its removal is not to be criticised; but when, as in many cases, there is no pain, it may safely be left undisturbed without risk of shortening the life of the patient. The speedy death which, with two exceptions, has followed enucleation raises the suspicion that the operation may in some inexplicable manner stimulate the other deposits to increased activity. A similar view is held by many surgeons in regard to sarcoma which has invaded the orbit, experience seeming to show that the fatal termination is precipitated by surgical interference. C. S. Bull[11] cites thirty-six cases of orbital sarcoma occurring among his private patients, in which the condition was aggravated and death apparently hastened by efforts to remove the growths. The following cases, which include all in which the eye has been removed for carcinoma of the choroid, certainly seem to indicate that enucleation should be postponed until increasing pain renders it imperative.

Case 7, by Mitvalski.[5]—Patient had been in good health since amputation of the breast, two years before. Died two months after enucleation, from metastasis in the brain and lungs.

Case 9, by Gayet.[9]—Patient was in good health when the eye was removed. Cachexia immediately developed, and death followed in a few weeks from cerebral metastases.

Case 10, by Ewing,[10] and Case 11, by Wadsworth,[11] appear to be exceptions to the rule, although neither surgeon had the patient under his observation very long after the operation. In reply to my inquiries Dr. Ewing kindly wrote Prof. Voelkers, at Kiel, for the subsequent history of his case, and the reply stated that she survived the operation about a year. Although this patient did not perish immediately after enucleation, her health rapidly deteriorated, and Dr. Ewing[10] expressed amazement that life remained in a being so cachectic. Dr. Wadsworth* was unable to add anything to the subsequent history of his case, as it passed into other hands, but he believes that she lived about a year after the enucleation.

Case 12, by Schultz.[12]—Patient died thirty-eight days after enucleation from bulbar paralysis.

Case 16, by Schultz.[16]—The physical condition was bad. The eye, becoming painful, was removed. Death followed in four months.

Case 17, by Kamocki.[17]—Male, aged thirty-seven years, was in the best of health. Eye deposit began one year before, and vision had been abolished four months previous to enucleation. Shortly after leaving the hospital, where he appeared to be perfectly healthy, he became ill, and died in a few weeks.

Case 21, by Marshall.[21]—Eye symptoms for two months preceding operation. Died two months later from abdominal carcinoma.

Case 24, by Wagenman.[23]—Patient was in good health, but died four months after operation from general carcinomatosis.

Case 25, by Le Grange.[24]—Died two months after enucleation from general carcinomatosis.

Case 27, by de Schweinitz.[26]—Survived the operation thirteen weeks, dying from cerebral metastasis.

Case 29, by Rockliffe.[28]—Patient lived twenty weeks after operation.

Case 30, by Oatman.—Patient was apparently in good health. Vision had been abolished eighteen months. Operation was immediately followed by a rapidly progressing marasmus, terminating fatally in five weeks.

Considering the history of these cases, it is not probable that when a metastasis has occurred in one eye its removal will tend to prevent a similar deposit in the other.

In the cases of Ewing[10] and Wagenman,[23] the remaining eye was attacked a month after the removal of its fellow.

Other Operative Procedures.

Case 5, Manz.[7]—Performed posterior sclerotomy to relieve the pain. A thin, yellow fluid escaped, but no relief followed.

Case 11, Wadsworth.[11]– For diagnostic purposes, aided by the ophthalmoscope, passed a cataract needle into the globe and pressed it against the tumor, which felt hard and resisting. He is probably mistaken in supposing that the rapid loss of vision which followed was in any way influenced by this procedure.

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* Personal correspondence.

Case 20, G. H. Mathewson.[20]—Performed posterior sclerotomy to relieve the detachment of the retina. Twenty-four hours later the fluid had re-formed.

RÉSUMÉ. A review of the literature yields thirty cases which are considered genuine.

The average age was 44.37 years.

Twenty of the primary growths were situated in the breast, three in the lungs, two in the liver, one in the stomach and liver, one in the thyroid, one in a dermoid cyst of the suprarenal body, and two not located.

There were twenty-two female and eleven male cases. This preponderance of three females to one male is not due to influence of sex, but to the greater frequency of carcinoma of the breast among women. One male case had carcinoma of the breast.

Twenty right eyes and nineteen left eyes were affected. This disproves the prevailing theory that the left eye is most frequently invaded.

Both eyes were involved in ten cases. While the deposit of a carcinomatous metastasis in the eye is an extremely rare event, when it occurs in one eye the other eye is also invaded in one-third of the cases. This bilateral peculiarity is ascribed to some unknown factor which ordinarily prevents the development of metastatic carcinoma in the choroids, but in these particular cases it is for some reason in abeyance.

The deposit always occurs posteriorly near the point where a short ciliary artery enters the globe. It appears in the corresponding region of the second eye when the latter is attacked. This indicates that the second eye is not invaded by way of the lymph channels of the optic nerve and chiasm.

The typical shape is a flat discoid thickening of the choroid with a central elevation of two or three millimetres, gradually sloping off to a thin periphery. It spreads laterally, because it is an infiltration of the choroidal lymph spaces with epithelial cells which naturally follow the path of least resistance. Sarcoma, on the contrary, is a growth of the fixed tissues.

The time from the first eye symptoms until vision is destroyed varies between two and eight weeks. The average is about five weeks. This rapid loss of vision is due to an early and extensive detachment of the retina. As choroidal carcinoma is always composed of glandular epithelial cells, it is assumed that their perverted secretion actively assists in producing the amotio retinæ.

Tension is increased in one-third and normal or diminished in two-thirds of the cases.

A typical ophthalmoscopic picture is "flat oval deposit or tumor on the temporal side of the nerve, involving the macula, with a central elevation of + 3 D., its edges gradually fading off into the surrounding fundus. Its color is a dirty-yellow, with scattered pigment spots." (Mitvalski's[5] case.)

The average duration of life after the first eye symptoms is six and one-half months.

In the differential diagnoses between carcinoma and sarcoma the following points are noted:

Carcinoma of the Choroid.	*Sarcoma of the Choroid.*
Always secondary.	"Secondary sarcoma of the choroid is unknown." (Fuchs.[43])
Has always occurred posteriorly. Usually on the temporal side of the nerve.	May occur at any point.
A flat discoid tumor or thickening of the choroid which spreads laterally.	It is a rounded protuberance growing out into the vitreous.
Has not been described as appearing vascular.	May appear vascular.
Early detachment of the retina.	Late detachment when centrally located. (Griffith.[37])
Destroys vision in a few weeks.	May exist for a long time with good vision.
May be very painful with T. N. or T.—.	Pain is due to T. ÷.
First symptom may be a rapid increase of hypermetropia without marked ophthalmoscopic changes.	Too circumscribed to produce this phenomenon.
T. may be diminished.	If confined to the choroid T. is never diminished. (Marshall.[38])

Pre-existing carcinoma will, of course, suggest the character of the eye deposit; but in seven cases the good health of the patients was a subject of comment. In five carcinoma was first disclosed by the microscope.

Enucleation is not advisable unless the eye is very painful or glaucomatous, since the histories appear to indicate that an increased activity in the cancerous processes and a speedy death may be ascribed to operation.

When a metastasis has occurred in one eye its removal does not prevent a similar deposit in its fellow.

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A REPORT OF CASES OF ANÆMIA, WITH OBSERVATIONS UPON THEIR SYMPTOMS AND MORPHOLOGY OF THE BLOOD.

BY J. ALISON SCOTT, M.D.,

PHYSICIAN TO PENNSYLVANIA HOSPITAL; PROFESSOR OF CLINICAL MEDICINE, PHILADELPHIA POLYCLINIC HOSPITAL.

I DESIRE to report the following cases, which occurred during the past winter in my service at the Pennsylvania Hospital:

Severe Secondary Anæmia Due to Repeated Metrorrhagia. Lizzie R., aged thirty years, white, married, housewife, born in Russia. Father died from unknown cause; mother died in confinement; has one sister in good health; lost one brother in childhood.